Disposal Safety Incorporated

To: Ken Clark

From: Steve Amter

Date: June 9, 1994

Subject: Source of arsenic in Dallas Housing Authority soils

Summary

At the Dallas Housing Authority housing project adjacent to the RSR Corporation Superfund Site, soils are contaminated by lead and arsenic. The lead contamination is universally agreed to originate from the smelter, but questions have been raised about the source of the arsenic. We have studied EPA data to determine the source of the arsenic. The data that we have obtained to date indicate that:

- Elevated arsenic levels in soil samples collected from the Dallas Housing Authority (DHA) property are closely correlated with elevated lead levels.
- Airborne emissions from the smelter are the source of the elevated lead and arsenic concentrations at the DHA property.
- Although antimony is extremely toxic and a good tracer of smelter-derived contamination, insufficient attention has been given to antimony levels in soils. Whenever possible, soil samples should be analyzed for antimony.

Background

Arsenic is a known component of the stack emissions from secondary lead smelters. Arsenic emissions from these smelters are substantial:

- According to EPA's Toxic Release Inventory, the RSR Indianapolis facility reported that it emitted 2,552 tons of lead and 281 tons of arsenic into the air between 1987

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and 1991.[1] In these years, the ratio of lead to arsenic ranged from 4 to 46, with a four-year average of 9.

- An EPA study of a Danish secondary lead smelter[2] found that the ratio of lead to arsenic emissions is variable and depends on the composition of the feed materials. Stack emission measurements collected on two different days contained lead to arsenic ratios of 36 and 248.

Since 1991, EPA Region 6 has been conducting an emergency removal action[3] in the residential areas (this includes public spaces such as playgrounds and school yards) surrounding the Dallas RSR smelter. Contaminated soil has been removed and replaced with clean fill at hundreds of properties. One area that has been studied but where soil removal has yet to begin is a large tract of low-income public housing owned by the Dallas Housing Authority.

To guide the removal, EPA established action levels of lead and arsenic. The action level for lead is 500 mg/kg. For arsenic, EPA has established more than one action level. In private residential areas, the standard is 20 mg/kg for the upper for six inches of soil and 50 mg/kg for deeper soils. In contrast, the standard applied for the public housing area is 50 mg/kg for both surface and deeper soils. We are not aware of any technical justification for this difference.

In response to our FOIA request, USEPA Region 6 sent us limited data on the concentrations of lead, arsenic, and cadmium in residential areas. Only data collected as part of the emergency removal action were provided. We also requested portions of additional data sets that were collected as part of the Remedial Investigation (RI). Initially, EPA erroneously took the position that it does not have to release these data because it has not yet finalized the RI report. Although EPA recently (June 2) reversed itself and agreed to

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[1]TRI data is not available on the RSR Dallas facility because it shut down before the Emergency Planning Community Right-to-Know Act came into existence.

[2]*Evaluation of Paul Bergsoe and Son Secondary Lead Smelter*, EPA report no. EPA-600/2-80-022, R.T. Coleman and R. Vandervort, January, 1980. RSR itself has cited this report as an authoritative source of information in a written comment to the USEPA RCRA Docket (Letter from G. Dumas, RSR Vice President of Environmental Affairs; subject: Burning Hazardous Waste in Boilers and Industrial Furnaces, July 27, 1987).

[3]Removals allow for rapid -- but usually limited -- responses for sites that have been proposed for the Superfund National Priorities List that circumvent the lengthy Remedial Investigation process. Removal Actions and Remedial Investigations may generate separate data bases. Although the remedial investigations for the residential areas are nearly complete, final clean-up standards and technologies will be specified in the Feasibility Study and the Record of Decision, which are one or more years distant.

provide the data, we don't yet have it. This additional information may be important because it includes analyses of antimony in residential soil, and antimony may be both of toxicological significance and a marker of smelter-derived contamination.

Analysis

The DHA property is north of and immediately adjacent to the RSR smelter property. Although soil contamination has occurred via atmospheric deposition, the housing project does not appear to have received fill containing lead waste. To investigate contamination levels in the soils of the DHA property, EPA divided it into 90 equal-area squares and collected soil samples from each. The soil data from the public housing area show that:

- The average lead and arsenic concentrations were 468 mg/kg and 17 mg/kg.

- EPA's removal-action standard of 500 mg/kg lead was exceeded on 27 squares; these areas, under current plans, will be cleaned up as part of the removal action.

- EPA's removal-action standard for the public housing area of 50 mg/kg arsenic was exceeded on 2 squares. On both of these, lead was also above the action level. These areas will be cleaned up.

- Arsenic concentrations exceeded 20 mg/kg (the standard applied to private residential soils) on 25 squares. On six of these, lead concentrations were below 500 mg/kg, which means that no emergency soil removal is currently planned.

One issue that is likely to be important is whether the elevated levels of arsenic found in the DHA soil are derived from the smelter. The possibility has been raised that the areas of the DHA property that contain elevated arsenic result from arsenic-containing pesticide (used on cotton to control bollweevils) or other sources. To test this possibility, we have compared arsenic levels to lead levels to see if the two are correlated.

If the both the lead and the arsenic originated from airborne emissions from the smelter, then the concentrations in soil should be correlated and bear some relationship to the history of stack emissions. On the other hand, if the arsenic in the soil originates from pesticide or some other source, then the concentrations should not be correlated.[4]

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[4]Areas of private housing near the smelter have been contaminated by both air deposition and disposal of slag. The ratio of lead to antimony in slag would be different, in general, from the ratio in air emissions. Our analysis was limited to the housing project in order to avoid this confounding factor.

Figure 1 is a plot of lead concentrations against arsenic concentrations. The points form a relatively straight line. Points shown by a triangle are those for which arsenic was below the detection limit, which varied between 3 and 14 mg/kg. For these points, the arsenic concentration is assumed to be equal to half the detection limit. Because the true arsenic concentrations are not known, the correlation coefficient and "best fit" line were calculated without these data points.

The arsenic concentrations appear to be highly correlated to the lead concentrations. Based on the 137 pairs of data from the DHA property in which arsenic was above the detection limit, the correlation coefficient was 0.824, where 1.000 equals perfect correlation. Such a strong correlation would be unlikely if the lead and arsenic had different sources.

If the "best fit" line (calculated using a linear fitting equation) is extended to the *y* intercept, it suggests that the "average" background arsenic concentration is near 7 mg/kg. Subtracting out this inferred background concentration for arsenic yields a lead to arsenic ratio of 50, which is within the range expected for air emissions from secondary lead smelters.

It is particularly significant that *all* samples with elevated arsenic also had elevated lead concentrations. For samples in which arsenic exceeded 40 mg/kg, the lowest lead concentration exceeded 1800 mg/kg. For samples whose arsenic exceeded 20 mg/kg, the lowest lead concentration was approximately 400 mg/kg, which is still clearly above background.

Thus three different aspects of the data -- the correlation, the lead-to-arsenic ratio, and the presence of elevated concentration of lead in all samples with high arsenic concentrations -- all support the conclusion that the arsenic, like the lead, came from the smelter.

The relevance of antimony data

Antimony is a relatively abundant constituent in both the slag and the stack emissions from secondary lead smelters. Antimony is found in much smaller concentrations than lead and arsenic in most uncontaminated soils. It also has fewer industrial uses. Thus, antimony is likely to be a good marker of soils that have been contaminated by wastes and emissions from the smelter. This point is demonstrated by soil data collected in the Remedial Investigation of RSR's inactive Seattle facility, where there was a greater degree of correlation between areas of elevated lead and elevated antimony than between lead and arsenic.

At the Dallas facility, EPA Region 6 appears to have paid insufficient attention to antimony. Most soil samples collected at the Dallas facility as part of the removal action were not analyzed for antimony because early data convinced EPA that is was not a health concern.[5] However, as discussed in the May 20, 1994 memo by Dr. John Young of the Hampshire Institute, the standard of 110 mg/kg used by EPA in the initial stages of the removal action is much too high; 30 mg/kg is a more appropriate standard for residential surface soil. At the present time we don't know the degree to which residential soils exceed 30 mg/kg.

Although we were told that some of the soil samples that were collected in Remedial Investigation have been analyzed for the full Toxic Compounds List, which includes antimony, we have not yet received these results. Thus, we presently don't know what fraction of soil samples collected from the private residential areas was analyzed for antimony. However, because of antimony's high toxicity and its value as a tracer of both slag and airborne emissions, we believe all samples collected in the future should be analyzed for antimony. Furthermore, if any old samples which were not analyzed for antimony still exist, these should be reanalyzed.

After initially denying our FOIA request, on June 2 we were informed by EPA's Remedial Project Manager that we will have access to the antimony data collected during the Remedial Investigation. Once we have obtained this, we plan to analyze antimony's relationship to lead and arsenic concentrations.

Conclusions

Arsenic is a known constituent of stack emissions from secondary lead smelters, and a statistical comparison of lead and arsenic concentrations in soil samples indicates that the arsenic in the housing project originated from the RSR Dallas smelter. Based on EPA surface soil standard of 50 mg/kg, arsenic concentrations will require the removal action in two grid sections of the public housing area. However, if the same 20 mg/kg standard used in the private residential areas were applied, arsenic would require removal from an additional 23 grid sections.

As both a health threat and a tracer of slag and emissions from secondary lead smelters, to date EPA Region 6 has paid insufficient attention to antimony in soils. Antimony data collected during the Remedial Investigation need to be carefully considered against a standard of 30 mg/kg. All samples collected in the future and any samples remaining in laboratory storage need to be analyzed for antimony.

[5]Telephone conversation with Ken Clark, USEPA Region 6, approximately May 11, 1994.

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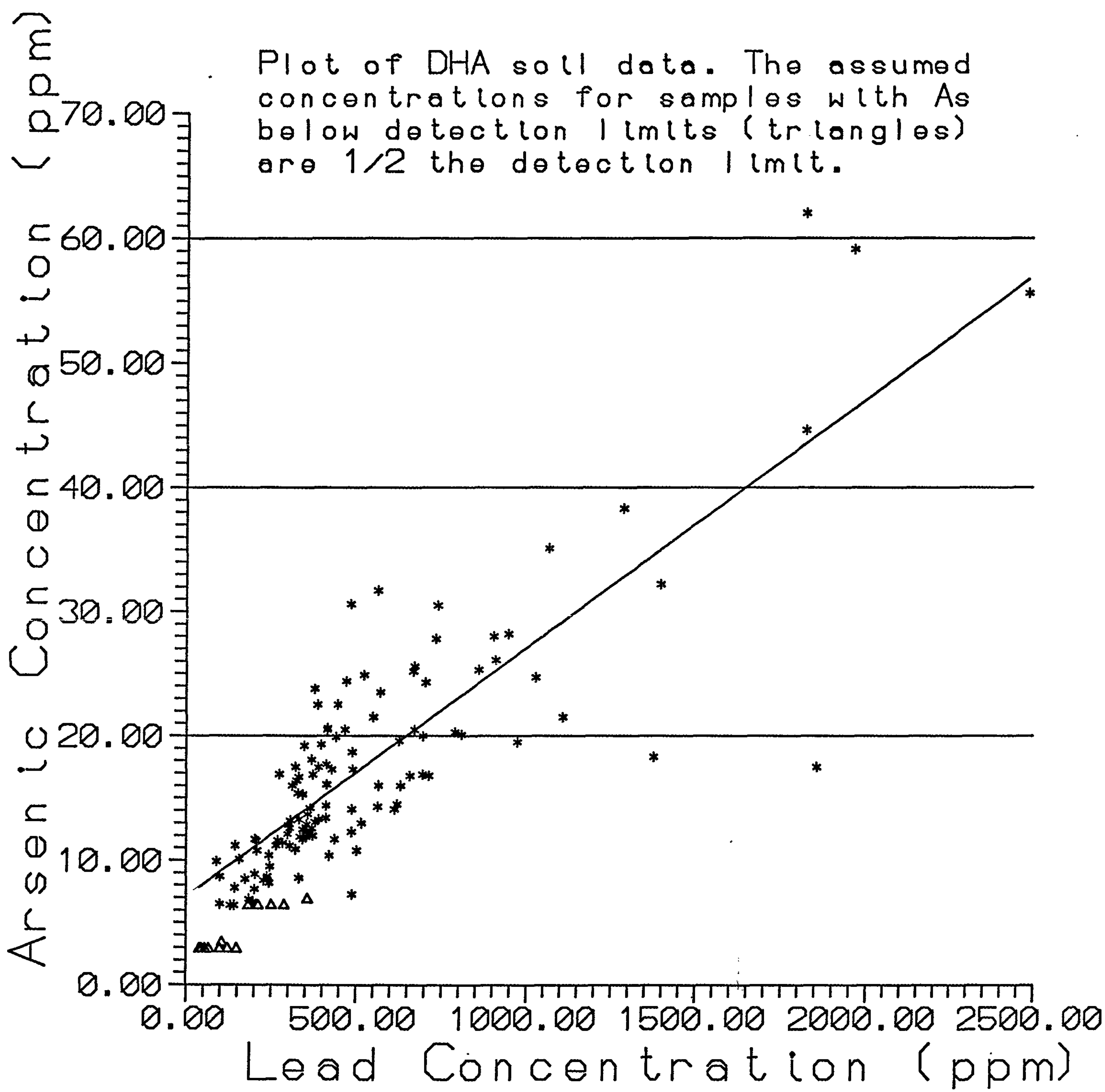
Plot of DHA soil data. The assumed concentrations for samples with As below detection limits (triangles) are 1/2 the detection limit.
Arsenic Concentration (ppm)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
Lead Concentration (ppm)
0.00
500.00
1000.00
1500.00
2000.00
2500.00